

OPERATING MANUAL

SBS MODEL 135

RESPONDER

OPERATING MANUAL
SBS MODEL 135
RESPONDER

Manufactured by
HEKIMIAN LABORATORIES, INC.
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Gaithersburg, Maryland 20877

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WARRANTY

Hekimian Laboratories, Inc., warrants the Model 135 Responder for a period of five years (parts and labor) per Contract No. 03-31-0009-31.

Hekimian Laboratories, Inc.
9298 Gaither Road
Gaithersburg, Maryland 20877 USA

VOLUME 1

EQUIPMENT DESCRIPTIVE DATA

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Volume 1 Equipment Descriptive Data

1.0 Introduction

1.01 This manual contains information needed for the proper operation and maintenance of the SBS Model 135 Responder. Volume 1 of the manual contains a general descriptive overview of the equipment which includes a description of leading particulars, physical characteristics of the unit, electrical requirements, a description of the software implementation, maintenance features, environmental considerations and a summary of the specifications data. Volume 2 consists of the instructions necessary for installation, checkout, operation and adaptation of the unit for use. In addition the topics of preventive maintenance, trouble analysis, and the required tools and test equipment are addressed.

1.02 The SBS Model 135 Responder is designed to perform access line quality measurements within either the Customer Network Services (CNS) or Message Service (MS) configured networks. Typically located at a distant customer PBX that does not provide direct inward dialing, the Model 135 will support centralized testing by a transmission test system located in either the Port Adapter System (PAS) or Specialized Carrier Switch (SCS).

2.0 Description of Leading Particulars

2.1 This section provides a description of the leading particulars related to the Model 135. Table A lists the mechanical features of the unit and Table B is a brief description of the functional performance features of the Model 135 Responders. Figure 2-1 shows the controls, indicators and connectors found on the front panel and provides information concerning their function.

TABLE A. MECHANICAL FEATURES

Dimensions	7.5 in (19.1 cm)H x 16.6 in (42.2 cm)L x 2.4 in (6.1 cm)W
Weight	3.75 lbs (1.7 kg)
Connector	Line/Monitor, Drop - Bantam Jack Telephone Lines - RJ11C
Mounting	Wall-type, metal enclosure

TABLE B. FUNCTIONAL PERFORMANCE

The Model 135 Responder meets the following overall functional objectives:

1. Contains one loop-start auto-answer port and one loop-start origination port.
2. Works in conjunction with manually controlled or automatic transmission test equipment to provide two-way characterization of interconnecting voice frequency transmission circuits.
3. Processes a DTMF number sequence from a DDD auto-answer port and outpulses the same number sequence at the origination port.
4. Is a self-contained wall mount unit suitable for use in a customer premises environment.
5. Has calibration and set-up controls that are accessible only to maintenance personnel.
6. Unauthorized use can be limited by implementation of a programmable authorization code.

With the following functional objectives for the Answer Port:

1. Detects incoming ringing and goes off-hook after one second (± 10 percent) of ringing.
2. Responds with a Call Progress Tone (CPT) of 1004 Hz for a period of 2.7 seconds.
3. Stores up to 23 address digits and 6 pauses, as received from the DDD answer port, for execution at the origination port.
4. Encodes Dual Tone Multifrequency (DTMF) instructions for the dial sequence and signaling format used by the origination port to outpulse an address.
5. Operates on a two-wire DDD subscriber telephone circuit.

With the following functional objectives for the Origination Port:

1. Goes off-hook upon control of internal functions.
2. Recognizes dial tone (precision and non-precision).

TABLE B. FUNCTIONAL PERFORMANCE (Continued)

3. Outpulses (DTMF or DP select option) call back numbers to circuits under test.
4. Recognizes Call Progress Tones (CPT) or other abort conditions (time out, etc.) from SBS.
5. Operates on a two-wire telephone circuit at the drop side of a PBX/CTX maintenance port.
6. Operates in an interactive or automatic sequenced mode under control of near end DTMF signaling.
7. Supports two-way insertion loss measurements at a frequency of 1004 Hz.
8. Supports two-way, three-point slope measurements at frequencies of 404 Hz, 1004 Hz, and 2804 Hz.

Note: The test tone transmit output of the Model 135 is nominally described as 2804 Hz to define it in a fashion consistent with the other two frequency outputs. The actual output of the transmit oscillator is a frequency of 2809 Hz.

9. Supports two-way C-message and 1010 Hz C-notched noise measurements.
10. Supports Echo Path Loss (EPL) measurements to a quiet termination.

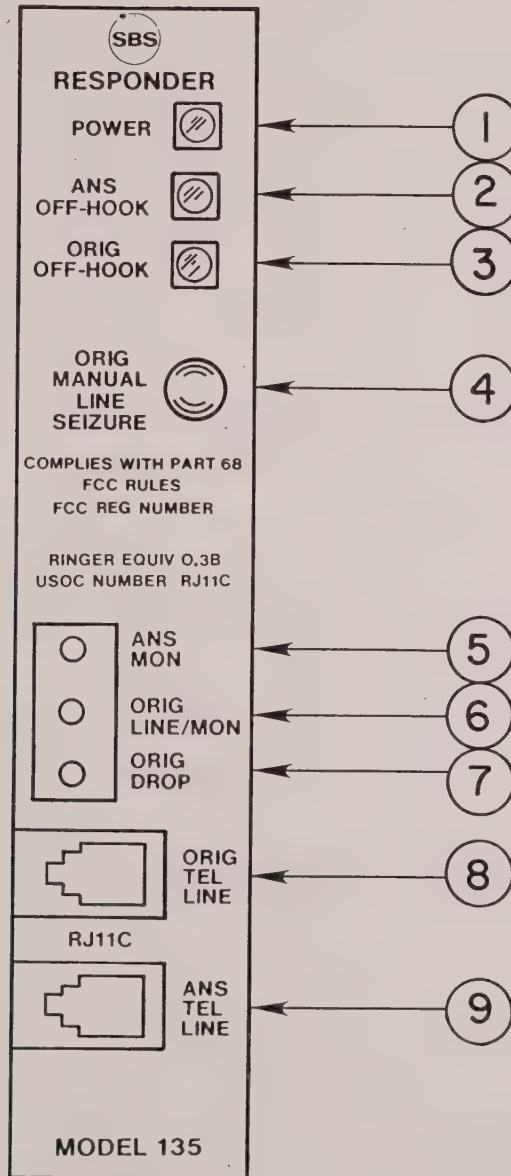


Figure 2-1. FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS

LEGEND FOR FIGURE 2-1, FRONT PANEL CONTROLS,
INDICATORS AND CONNECTORS

- ① POWER Indicator - LED lights to indicate unit is receiving electrical current.
- ② ANS OFF-HOOK Indicator - LED lights to indicate when the answer port is in the off-hook condition
- ③ ORIG OFF-HOOK Indicator - LED lights to indicate when the origination port is in the off-hook condition.
- ④ ORIG MANUAL LINE SEIZURE - Momentary switch to provide manual activation of the origination port holding circuit.
- ⑤ ANS MON Jack - Bantam jack which provides a means to monitor the answer port.
- ⑥ ORIG LINE/MON Jack - Bantam jack which provides a means to access and monitor the line under test.
- ⑦ ORIG DROP Jack - A make/break Bantam jack that provides access to the responder for calibration purposes.
- ⑧ ORIG TEL LINE - Provides the interconnection to the 2-wire test line from the origination port.
- ⑨ ANS TEL LINE - Provides the interconnection to the 2-wire DDD subscriber line from the answer port.

3.0 Physical Characteristics

3.1 The Model 135 Responder is designed to meet the requirements contained within the CFR 47 Part 68 FCC Rules and Regulations. The responder electronic component module is contained within a metal wall-mount enclosure designated Model 100A, suitable for use in a customer premises environment. In this configuration the unit is completely self-contained, excluding the external wall-mount power transformer, and incorporates the quick disconnect features of the RJ11C interface to provide access to the 2-wire telephone circuits.

3.2 Figure 3-1 is the overall outline of the Model 135 enclosure. Figure 3-2 is the unit assembly drawing showing key features and components.

ATTACHED
ENCLOSURE

Figure 3-1. OVERALL OUTLINE OF MODEL 135 ENCLOSURE

ATTACHED
FOLDOUT

Figure 3-2. MODEL 135 RESPONDER UNIT ASSEMBLY DRAWING

LEGEND FOR FIGURE 3-2, MODEL 135 RESPONDER
UNIT ASSEMBLY DRAWING

- ① Analog PC Board Assembly 125-101
- ② Digital PC Board Assembly 125-201
- ③ Wall-Mount Enclosure Chassis
- ④ Wall-Mount Enclosure Cover
- ⑤ 1/4 Turn Latch Fastener
- ⑥ AC Power Adapter - Wall Mount Plug-in Transformer
- ⑦ Test Tone Setup Switch (S3)
- ⑧ 1 Amp, Slow-Blow Type Fuse, 2 per assembly
- ⑨ Reference Impedance Selection Switch (S1)
- ⑩ Authorization Code Selection Switch (S4)
- ⑪ Transmit Level Adjustment Potentiometer, R103
- ⑫ Electronics Module Power Wire Harness Plug

4.0 Electrical Characteristics

4.1 The Model 135 Responder operates on ac power in the 105 to 130V ac, 47 to 67 Hz range available at the customer premises via a standard 3-prong NEMA 5-15R receptacle. The Responder interfaces with the ac power source via a wall mounted transformer. It provides the first stage of the power conversion required to produce the $\pm 12V$ dc at 150 mA and $\pm 9V$ dc at 250 mA necessary for the operation of the responder module. The ac line cord attached to the ac adapter transformer is 9 feet in length and therefore it is necessary to mount the Model 135 within a distance of 9 feet of the receptacle.

5.0 Software/Firmware Characteristics

5.1 The software program that provides functional control of the Model 135 Responder is contained in one EPROM. The software is encompassed within 4K of Firmware with an additional 1K of RAM. Program timing is controlled by a real time clock that is part of the responder circuitry. The program operates either under control of the internal clock or from external commands. The program is written to accept DTMF digits as valid interrupts and requests for a change in state. The overall run-time for the program is variable based on user inputs at the time of test.

6.0 Maintenance Features

6.1 All access to the Model 135 is via the jacks located on the unit's front panel. Refer to Figure 2-1 for further clarification.

6.2 The Model 135 does not have any internal self-check functions, and unit performance testing involves functional Go/No Go type testing. The performance criteria for the Model 135 are defined in the Specification Data Summary, Table C of this manual. Any functional performance which falls outside the limits defined in Table C would be noted as a failure.

6.3 The Model 135 Responder is a FCC Registered device in accordance with CFR 47 Part 68, FCC Rules and Regulations. All maintenance outside of routine maintenance will be performed by the original equipment manufacturer. The Model 135 has no requirement for the performance of any routine or preventive maintenance.

6.4 The design of the Model 135 facilitates field replacement of failed units. When a unit fails, it is replaced with a new unit so the failed unit can be returned for repair.

6.5 There are no special safety or hazard considerations when working with the Model 135 Responder.

7.0 Environmental Considerations

7.1 The Model 135 Responder operates within a variety of customer premise locations with operating temperatures that range from 0°C to 50°C. The only restriction on its installation is the requirement to protect the unit from direct exposure to weather or moisture.

7.2 As a requirement for FCC Registration, the Model 135 successfully withstood cyclical temperature and humidity testing. The unit testing involved cycling through the following temperature and humidity conditions three times: 30 minutes at 150°F and 15 percent relative humidity, followed by 30 minutes at 90°F and 90 percent relative humidity, followed by 30 minutes at -40°F and any convenient humidity.

7.3 There are no special EMI requirements or restrictions related to the Model 135 Responder.

8.0 Specifications Data Summary

8.1 A summary of the specifications for the Model 135 Responder are contained in Table C.

Table C. SPECIFICATIONS (Continued)

InterfaceAnswer Port:

Interface connector: RJ11C connector in compliance with 47 CFR Part 68
Impedance: 750 ohms fixed
Line protocol: loop-start
Ring detection: 15.3 Hz to 68.0 Hz, 40V to 150V RMS, ringer equivalence 0.38

Origination Port:

Interface connector: RJ11C connector in compliance with FCC Part 68
Impedance: 600 ohms or 900 ohms, selectable
Line protocol: loop-start
Return loss: greater than 30 dB
Hold coil resistance: 200 ohms ± 5 percent
Hold coil current: 100 milliamps, maximum
Longitudinal balance: greater than 50 dB, 20 Hz to 6 KHz

Test Tones

Frequencies: 1004 Hz; 404 Hz; 2804 Hz
Accuracy of frequency: ± 0.2 percent
Level: selectable from -10.0 dBm to -20.0 dBm (factory set at -10.0 dBm, reference 600 ohms)
Accuracy of level: ± 0.1 dB
Spurious and harmonic content: greater than 55 dB below test tone level

Level Measurements

Range: 0.0 dBm to -50.0 dBm
Accuracy of level: ± 0.2 dB over the range of 0.0 dBm to -50.0 dBm
Transmit tone: transmit 1004 Hz at a level equal to received level between -10.0 dBm and -50.0 dBm

Table C. SPECIFICATIONS (Continued)

Noise Measurements

Weighting filters: C-message and C-notched (1010 Hz)
Range: +10.0 dBrnC to +50.0 dBrnC, at 0.0 TLP
Accuracy: ± 1.0 dB from +20 to +60 dBrnC.
Transmit tone: transmit 1004 Hz tone at a level equal to
received noise level plus 30 db between -10 and -50 dBm

Echo Return Loss

Type: provides quiet termination

Quiet Termination

Quiet termination: selected impedance ± 1 percent plus 2.16
microfarads ± 1 percent

OPERATIONAddressing and SupervisionDTMF Dialer:

Number: Up to 23 digits and 6 pauses; DTMF symbol "#" equals
1-second pause

Tones: DTMF tones in accordance with AT&T.
"Touch-Tone-Calling -- Requirements for CO's, Technical
Advisory No. 12."

Pulse Dialer:

Number: Up to 23 digits and 6 pauses.

Pulses: Current interruptions per A.T.&T. "Notes on the
Network", section 5.0. Pulses can be impressed on two-
wire loop start circuits

Loop start alerting: Initiation and response to standard loop
start alerting per A.T.&T. "Notes on the
Network," section 5.0.

Table C. SPECIFICATIONS (Continued)Dial Tone Detection:

Type: Tone detector

Frequencies: Precision and non-precision dial tone

Alerting tests: Loop start circuits tested to determine if alerting produces the correct response (i.e. loop start closure draws dial tone) and if receipt of dialing produces the correct response.

Test Sequence Preamble

Acknowledgment: Responder origination port initiates 1004 Hz "acknowledge tone" commencing 2 seconds after "off-hook" for a period of 30 seconds.

Note: If default at 30 seconds occurs, then the responder port immediately goes "on-hook".

Authorization Code: A DTMF code is derived from the 4 X 4 key pad matrix, consisting of an alphabetical character followed by two numerical digits. This three character sequence, pulsed one time (only) toward the origination port, is manually programmable within the responder by an internal Dual In-Line Package (DIP) switch. A combination of the DIP switch settings will bypass the authorization code requirement.

1. Recognition. If a valid DTMF authorization code is recognized by the responder, it will reset the timer and provide a quiet termination.
2. Default. If the responder fails to detect DTMF tones matching the internal DIP switch settings for the authorization code, the port will go "on-hook" at the expiration of the 30-second timer.

Set Mode

1. Automatic. When the responder detects the DTMF digital pair "24", the responder automatic sequence will commence in 2 seconds.
2. Interactive. Functions and intervals are determined by suitable external DTMF commands. When the responder detects any other DTMF digit pair, the responder will provide the corresponding function.

Table C. SPECIFICATIONS (Continued)

Automatic Test Sequence

<u>Measurement Direction</u>	<u>Responder</u>	<u>Test Equipment</u>
<F to N>	(1) Transmit 1004 Hz	Measure Level
	(2) Transmit 1004 Hz	Measure C-Notch Noise
	(3) Go Quiet	Measure C-Message Noise
	(4) Transmit 404 Hz	Measure Level
	(5) Transmit 2804 Hz	Measure Level
<N to F>	(6) Set 1004 Hz Level Indication	Transmit 1004 Hz
	(7) Set C-Notch Noise Indication	Transmit 1004 Hz
	(8) Set C-Message Indication	Go Quiet
	(9) Set 404 Hz Level Indication	Transmit 404 Hz
	(10) Set 2804 Hz Level Indication	Transmit 2804 Hz
<F to N>	(11) Transmit 404 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 404 Hz
	(12) Transmit 1004 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 1004 Hz
	(13) Transmit 2804 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 2804 Hz
	(14) Transmit C-Notch Noise Registered Level (+30 dB of the C-Notch Noise)	Measure Level at 1004 Hz (Add +60 dB Algebraically to Convert to dBrnC)
	(15) Transmit C-Message Noise Registered Level (+30 dB of the C-Message Noise)	Measure Level at 1004 Hz (Add +60 dB Algebraically to Convert to dBrnC)
<N to F>	(16) Go Quiet	Transmit White Noise & Measure EPL

Go "On-Hook"

Note 1: Automatic sequence timer provides 6 seconds for each step.

Note 2: The measurement of results by either the responder or test equipment will commence two (2) seconds after the beginning of each 6-second interval.

Note 3: "<N to F>" (Near to Far) indicates the direction of circuit transmission between, e.g., the test equipment being near and the responder being far.

"<F to N>" (Far to Near) indicates the reverse direction of circuit transmission

Table C. SPECIFICATIONS (Continued)

Interactive

<u>DTMF Command</u>	<u>Function</u>
22	Find Line Loss
23	Reset Line Loss to 0
24	Start Automatic Sequence
32	Transmit Tone at 404 Hz
33	Transmit Tone at 1004 Hz
34	Transmit Tone at 2804 Hz
42	Measure 404 Hz Level
43	Measure 1004 Hz Level
44	Measure 2804 Hz Level
46	Transmit Indicated 404 Hz Level @ 1004 Hz
47	Transmit Indicated 1004 Hz Level @ 1004 Hz
48	Transmit Indicated 2804 Hz Level @ 1004 Hz
62	Measure C-Notch Noise
63	Measure C-Message Noise
64	Transmit Indicated C-Notch Noise at 1004 Hz +30 dB above the Measured C-Notch Noise
66	Transmit Indicated C-Message Noise at 1004 Hz +30 dB above the measured C-Message Noise
72	Set Time Out Default Equal to 2 Min.
73	Set Time Out Default Equal to 5 Min.
74	Set Time Out Default Equal to 10 Min.
76	Set Time Out Default Equal to 15 Min.
77	Set Time Out Default Equal to 17 Min.
82	Quiet Termination
83	"On-Hook"

Note: The first digit of each DTMF command dictates the function listed below.

- 2 - Special Functions
- 3 - Test Tones
- 4 - N to F Level Measurement and Reply
- 6 - N to F Noise Measurement and Reply
- 7 - Time Out Option
- 8 - Non-Measurement Functions

Table C. SPECIFICATIONS (Continued)

Power

Power: 115V ac, 60 Hz ± 10 percent

Power cord: 9-feet maximum, mates to NEMA 5-15R Receptacle

VOLUME 2

PERFORMANCE AID DATA

VOLUME 2

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Volume 2 Performance Aid Data

1.0 Introduction

1.01 This manual contains information needed for the proper operation and maintenance of the SBS Model 135 Responder. Volume 1 of this manual contains a general descriptive overview of the equipment which includes a description of leading particulars, physical characteristics of the unit, electrical requirements, a description of the software implementation, maintenance features, environmental considerations and a summary of the specifications data. Volume 2 consists of the instructions necessary for installation, checkout, operation and adaptation of the unit for use. In addition the topics of preventive maintenance, trouble analysis, and the required tools and test equipment are addressed.

1.02 The SBS Model 135 Responder is designed to perform access line quality measurements within either the Customer Network Services (CNS) or Message Services (MS) configured networks. Typically located at a distant customer PBX that does not provide direct inward dialing, the Model 135 will support centralized testing by transmission test systems located in either the Port Adapter System (PAS) or Specialized Carrier Switch (SCS).

2.0 Adaptation For Use

2.01 This section contains the information necessary to setup the Model 135 for operation. Although the Model 135 is a simple device to use, it requires that certain operational variables be preset to take into account how and where the responder is deployed. These variables are: Authorization/ Security Code Selection, Origination Port Reference Impedance Selection, Test Tone Transmit Level Adjustment and Line Loss Compensation.

A. Authorization/Security Code Selection

2.02 The authorization/security code for the Model 135 consists of an alphabetical character followed by two numerical digits. The alphabetical character is preprogrammed as part of the firmware located in the Model 135. The two numerical digits that make up the rest of the code are set by the 8 section DIP Switch, S4 located on the 125-201 Board. Refer to Figure 2-1 for the switch location and markings. Each section of the switch is a different binary value and the value to be set by a particular section of the switch is marked on the PC board. Notice also the numbers "1" and "0" are labeled on the PC board. These numbers are to be used as a reference to indicate the proper switch setting. When the switch is set to the side indicated by "1", the bit corresponding to that value is set and conversely setting the

switch in the "0" direction sets the bit to zero for that value. Table D lists the possible authorization codes and the proper DIP switch settings for each of the codes. Table D references all the switch settings to the PC board markings.

2.03 Set or verify the authorization/security code by performing the following:

NOTE: The authorization/security code selection must be made with the unit disconnected from the ac power. The information contained on the DIP switch can only be encoded in the responder firmware at "power up." **ANY CHANGES, THEREFORE, TO THE SWITCH SETTING WHILE THE UNIT IS UNDER POWER WILL NOT BE ENCODED UNTIL AFTER THE POWER IS REMOVED AND THEN REAPPLIED.**

(1) Place the Model 135 on a work surface with the enclosure cover facing up and the front panel facing towards your left.

(2) Remove the enclosure cover by first rotating the two black plastic latch assemblies one quarter turn. Then lift the cover off the unit by grasping the left and right edges of the cover and lifting straight up.

(Continued on Page 2-6)

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Figure 2-1. MODEL 135 RESPONDER UNIT ASSEMBLY DRAWING

LEGEND FOR FIGURE 2-1, MODEL 135 RESPONDER
UNIT ASSEMBLY DRAWING

- ① Analog PC Board Assembly 125-101
- ② Digital PC Board Assembly 125-201
- ③ Wall-Mount Enclosure Chassis
- ④ Wall-Mount Enclosure Cover
- ⑤ 1/4 Turn Latch Fastener
- ⑥ AC Power Adapter - Wall Mount Plug-in Transformer
- ⑦ Test Tone Setup Switch (S3)
- ⑧ 1 Amp, Slow-Blow Type Fuse, 2 per assembly
- ⑨ Reference Impedance Selection Switch (S1)
- ⑩ Authorization Code Selection Switch (S4)
- ⑪ Transmit Level Adjustment Potentiometer, R103
- ⑫ Electronics Module Power Wire Harness Plug

Table D. AUTHORIZATION CODES

"SEC CODE" SWITCH (S4)									
DECIMAL VALUE	TEN'S				ONE'S				
BCD VALUE	8	4	2	1	8	4	2	1	
SEGMENT	1	2	3	4	5	6	7	8	
POSSIBLE AUTHORIZATION CODES	22	0	0	1	0	0	0	1	0
	23	0	0	1	0	0	0	1	1
	24	0	0	1	0	0	1	0	0
	26	0	0	1	0	0	1	1	0
	27	0	0	1	0	0	1	1	1
	28	0	0	1	0	1	0	0	0
	32	0	0	1	1	0	0	1	0
	33	0	0	1	1	0	0	1	1
	34	0	0	1	1	0	1	0	0
	36	0	0	1	1	0	1	1	0
	37	0	0	1	1	0	1	1	1
	38	0	0	1	1	1	0	0	0
	42	0	1	0	0	0	0	1	0
	43	0	1	0	0	0	0	1	1
	44	0	1	0	0	0	1	0	0
	46	0	1	0	0	0	1	1	0
	47	0	1	0	0	0	1	1	1
	48	0	1	0	0	1	0	0	0
	62	0	1	1	0	0	0	1	0
	63	0	1	1	0	0	0	1	1
	64	0	1	1	0	0	1	0	0
	66	0	1	1	0	0	1	1	0
	67	0	1	1	0	0	1	1	1
	68	0	1	1	0	1	0	0	0
	72	0	1	1	1	0	0	1	0
	73	0	1	1	1	0	0	1	1
	74	0	1	1	1	0	1	0	0
	76	0	1	1	1	0	1	1	0
	77	0	1	1	1	0	1	1	1
	78	0	1	1	1	1	0	0	0
	82	1	0	0	0	0	0	1	0
	83	1	0	0	0	0	0	1	1
	84	1	0	0	0	0	1	0	0
	86	1	0	0	0	0	1	1	0
	87	1	0	0	0	0	1	1	1
	88	1	0	0	0	1	0	0	0

SBS CONFIDENTIAL

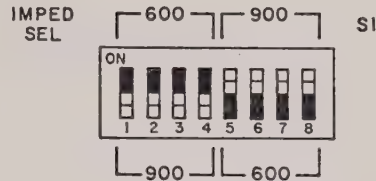
(3) Locate switch S4, labeled "SEC CODE" on the 125-201 board.

(4) Verify or set the desired authorization/security code using Table D as a guide.

NOTE: The Model 135 is preset at the factory with all the switch sections set to "0". A setting of all "0's" removes the requirement to enter an authorization code to begin a test sequence.

B. Origination Port Impedance

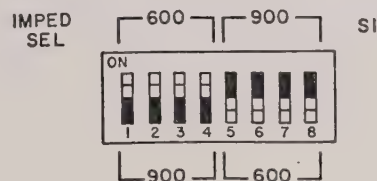
2.04 The Model 135 provides a test line termination via the origination port with either a 600 or 900 ohm reference impedance. The desired reference impedance is selected by setting the 8 section DIP switch, S1 located on the 125-101 board.



S1 set for 600 Ω Reference Impedance

2.05 Set or verify the reference impedance of the origination port by performing the following:

(1) Locate the 8 section DIP switch S1, labeled "IMPED SEL" mounted on the lower left section of the 125-101 board. The switch is visible through the cutout found on the 125-201 board.



S1 set for 900 Ω Reference Impedance

(2) Select the desired reference impedance of either 600 ohm or 900 ohm. Figure 2-2 shows the proper setting for either reference impedance.

Note: The reference impedance is preset at the factory for 900 Ω .

Figure 2-2. Origination Port Impedance Selection Switch

C. Test Tone Transmit Level Adjustment

2.06 The test tone transmit level is adjustable between -10 dBm and -20 dBm and is settable to any reference level in that range. The actual transmit level setting should be adjusted to agree with requirements established in the network transmission and test plans. The Model 135 is preset at the factory at a -10 dBm level.

2.07 Adjust the test tone transmit level by performing the following:

(1) Plug the Model 135 ac adapter into an ac receptacle. The LED labeled POWER will light, indicating the power is applied to the Model 135.

(2) Connect a transmission measurement set or level meter to the ORIG DROP jack on the Model 135 using a bantam plug. This reference measurement device should have a 0.1 db resolution and accuracy with the appropriate 600 Ω or 900 Ω characteristic impedance.

(3) Momentarily depress switch S3, protruding from the middle of the top edge of the 125-201 board. Check the ORIG OFF-HOOK indicator LED on the front panel for the indication of the off-hook condition. The LED will light to indicate off-hook.

(4) Adjust the 20 turn potentiometer R103 located on the left hand portion of the 125-101 board, to set the desired transmit level. There is an access hole

located on the left hand portion of the 125-201 board to allow you to insert an adjustment tool into the adjustment screw on the pot.

(5) Momentarily depress S3 to return the Model 135 to the on-hook condition.

NOTE: If S3 is not depressed, the Model 135 will automatically revert to the on-hook condition 2 minutes after S3 was initially depressed.

(6) Remove the plug from the ORIG DROP jack and replace the cover.

D. Compensation For Line Loss

2.08 Figure 2-3 shows the most typical deployment arrangement for the Model 135. In this deployment arrangement, the Model 135 is collocated with the distant end of the circuit under test and it is assumed that no additional line loss will be introduced to the test results.

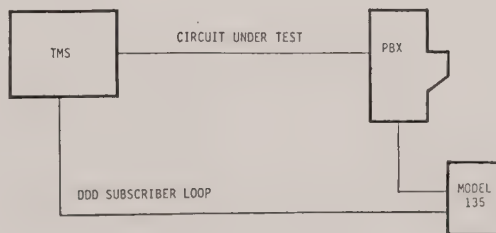


Figure 2-3. Typical Model 135 Deployment Arrangement

However, because the Model 135 origination port will perform all the functions of the Model 125 Responder it may be employed in a situation as depicted in Figure 2-4. The situation depicted in Figure 2-4, represents the case where the Model 135 gains access to the distant end switch under test via an access line with measurable loss and as a result, will introduce some additional line loss in the test results.

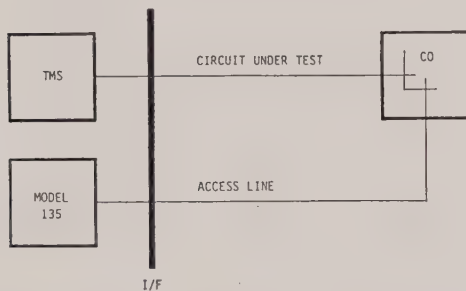


Figure 2-4. Model 135 Located on an Access Line with Measurable Loss

2.09 Any deployment arrangement similar to that depicted by Figure 2-3, will not require additional setup of the Model 135 prior to testing.

2.10 If desired, the Model 135 can be adjusted so as to eliminate or "zero out" the effects of the access line loss depicted in Figure 2-4. Two separate adjustment operations are required to achieve the complete adjustment for the effects of loop loss in the access line. It will be necessary to make an adjustment to the transmit level of the 1004 Hz test tone due to the effect of the far to near loss in the loop and its impact on the test results. In addition to this

adjustment, it will be necessary to introduce a correction factor, which accounts for the impact of the near to far loss, in the access line on all measurements taken by the Model 135 in this particular deployment arrangement.

2.11 To zero out or subtract the effect of the line loss on the transmit level of the 1004 Hz test tone, perform the following:

NOTE: The ORIG TEL LINE interface must be disconnected from the Model 135 during this procedure to insure that all adjustments are made against the reference characteristic impedance as prescribed in paragraph 2.07.

(1) Determine the access line loss by measuring a known test tone source from the TELCO CO which provides switching for the line. The measurement should be taken with a TMS terminated on the near end of the access line in place of the Model 135.

(2) Adjust out this line loss using the calibration techniques described in paragraph 2.07, adding sufficient gain to equal the measured loop loss on the access line. Refer to the following example and Figure 2-5 for further details.

Example:

Desired Transmit level	
at the distant switch	
under test=	-20.0 dBm
F>N loop loss for the	
access line=	<u>(-) -1.5 dB</u>
Adjusted Transmit	
level of the	
Model 135=	-18.5 dBm

Gain in the Transmit level of the Model 135 Test tone = F>N Loop Loss in the access line.

2.12 To subtract out the effect of the line loss in the access line on the measurements made by the Model 135, different

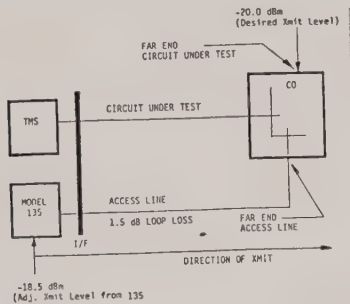


Figure 2-5. 1004 Hz Test Tone Adjustment

techniques are used. The Model 135 is designed so that, after it receives a DTMF Command 22, it detects "Line Loss" using -20 dBm as a reference level. When commanded to detect "Line Loss," the Model 135 compares the level received against this reference and considers any deviations from the reference as the line loss in the access line. Once the Model 135 has determined this line loss, it will apply an adjustment factor to all subsequent measurements.

2.13 Setting the "Line Loss" adjustment factor in the Model 135 can be accomplished by either of two methods based on the location of the Model 135.

Method #1 Local Adjustment

2.14 To set the line loss adjustment factor when you are able to gain direct access to the

Model 135 to be adjusted, perform the following:

(1) Determine the access line loss using the method described in paragraph 2.11 (1).

(2) Adjust a TMS to transmit a 1004 Hz tone at a reference level of -20 dBm plus the loop loss in the access line. Refer to the following example and Figure 2-6 for further details.

Example:

Line Loss	
Reference Level=	-20.0 dBm
Loop Loss for the	
Access Line=	(+)-1.5 dB
Adjusted Transmit	
Level for the TMS=	-21.5 dBm

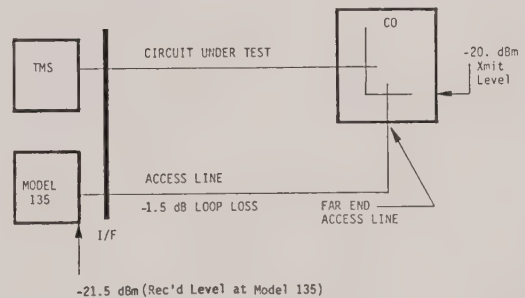


Figure 2-6. Effect of Access Line Loop Loss on Reference Level

(3) Push the ORIG MANUAL LINE SEIZURE button located on the front panel of the Model 135. Observe that the LED indicates an off-hook condition.

(4) Wait 3 seconds to allow completion of the FCC required quiet termination.

(5) Send 3 Character DTMF authorization code (if required).

(6) Send the DTMF Command 72 to hold the Model 135 in the off-hook condition for 2 minutes.

(7) Send the DTMF Command 22 to detect and store the line loss.

(8) Connect the TMS output to the ORIG DROP jack on the Model 135 using a bantam plug.

NOTE: This connection must be completed within 5 seconds of sending the 22 command for an accurate measurement to be made by the Model 135.

(9) Wait a minimum of 10 seconds to ensure completion of the desired measurement.

(10) Disconnect the TMS from the ORIG DROP jack on the Model 135.

NOTE: The Model 125 will be held off-hook and therefore inaccessible via the Tel Line interface until the selected off-hook timeout sequence is complete and the unit automatically goes on-hook.

Method #2 Remote Adjustment

2.15 To set the line loss adjustment factor through remote access of the Model 135, perform the following:

(1) Determine the loop loss on the circuit between the TMS and the TELCO CO portrayed in Figure 2-4 using a known test tone source in that CO.

(2) Adjust the transmit level of the TMS test tone so that the gain is equal to the loop loss just measured. Refer to the following example and Figure 2-7 for further details.

Example:

Desired Reference	
Transmit Level at	
TELCO CO=	-20.0 dBm
Measured Loop Loss=	<u>(-)-2.0 dB</u>
Adjusted Transmit	
Level of TMS=	-18.0 dBm

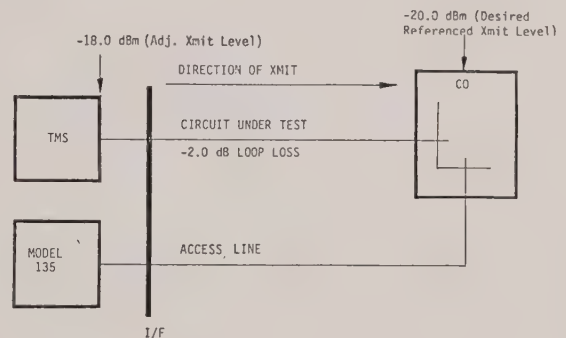


Figure 2-7. TMS Adjustment for Reference Level

(3) Dial the Model 135 via its assigned NNx to complete the circuit and put the unit in the off-hook condition.

(4) Wait 3 seconds to allow completion of the FCC required quiet termination.

(5) Send 3 Character DTMF authorization code (if required).

(6) Send the DTMF Command 72 to hold the Model 135 in the off-hook condition for 2 minutes.

(7) Connect the TMS to the Circuit on which the Model 135 has been "dialed-up."

(8) Transmit the 1004 Hz test tone at the level adjusted in Step 2.

(9) Send the DTMF Command 22 to detect and store the line loss.

(10) Wait a minimum of 10 seconds to insure completion of the desired measurement.

(11) Send the DTMF Command 83 to return the Model 135 to the on-hook condition.

NOTE: The ability of the Model 135 to retain the adjustment for line loss programmed via the DTMF command 22 is dependent on the unit not losing power. SHOULD THE MODEL 135 BE DISCONNECTED FROM A POWER SOURCE, OR EXPERIENCE A POWER FAILURE, THE PROCEDURES TO SET THIS LINE LOSS ADJUSTMENT FACTOR MUST BE REPEATED.

3.0 Checkout

3.01 This section contains the information necessary to verify the performance of the Model 135 Responder. Because the Model 135 is an FCC registered device, it is designed to be removed from the circuit and replaced with a functioning unit if a failure occurs. As a result of this FCC Registration, any repairs to the circuit with the exception of fuse replacement, must be performed by the factory. The following tests, therefore, are simple go/no-go type performance checks.

NOTE: Because the following tests are go/no-go type performance checks, measurements within ± 1 dB of the expected values are acceptable unless otherwise noted.

A. Ac Power Check

3.02 To check the ac power circuit, perform the following:

(1) Plug the Model 135 ac adapter into an ac receptacle.

(2) Verify that the LED labeled POWER located on the front panel is lit, indicating the unit has power.

B. Answer Port Ring Detection Check

3.03 To check the ability of the answer port to detect ring, perform the following:

(1) Connect a TMS that is set for a receive level measurement to the TEL LINE interface of the Model 135.

(2) Apply a minimum of 1 second of ringing voltage via the ANS TEL LINE interface on the Model 135.

(3) Observe that the ANS OFF-HOOK indicator LED on the unit front panel lights.

(4) Wait 3 seconds.

(5) Detect the presence of the 1004 Hz acknowledgment tone.

C. Origination Port Ring Detection Check

3.04 To check the ability of the origination port to detect ring, perform the following:

(1) Connect a TMS that is set for a receive level measurement to the TEL LINE interface of the Model 135.

(2) Apply a minimum of 1 second of ringing voltage via the ORIG TEL LINE interface on the Model 135.

(3) Observe that the ORIG OFF-HOOK indicator LED on the unit front panel lights.

(4) Wait 3 seconds.

(5) Detect the presence of the 1004 Hz acknowledgment tone.

D. Manual Line Seizure Check

3.05 To check the Manual Line Seizure switch function, perform the following:

(1) Connect a TMS that is set for a receive level measurement to the ORIG TEL LINE interface.

(2) Depress the Manual Line Seizure switch located on the Model 135 front panel.

(3) Observe that the ORIG OFF-HOOK indicator LED on the unit front panel lights.

(4) Wait 3 seconds.

(5) Detect the presence of the 1004 Hz acknowledgment tone.

E. Answer Port Encoding/ Origination Port Outpulse Function Check

3.06 To check the ability of the answer port to respond to DTMF signals, encode an address, initiate the signal outpulsing process and have the origination port outpulse the encoded address, perform the following:

(1) Connect a TMS capable of sending DTMF to the ANS TEL LINE interface of the Model 135.

(2) Connect a Hekimian Laboratories, Inc., Dialed Number Recorder, Model 110 or similar device to the ORIG TEL LINE interface of the Model 135.

Note: Although the use of a dialed number recorder is the preferred method for verifying the address encoded and then outpulsed, any set-up that will allow the completion of a call to a telephone station within the range of observation of the tester will suffice. It will also be necessary to connect a TMS to the ORIG LINE/MON jack on the Model 135 to provide a monitor of the signal outpulsing. The TMS should be set for a bridged receive level measurement and provide an audio monitor on the receive circuit.

(3) Connect an active two-wire telephone line to the ORIG TEL LINE interface on the Model 135.

(4) Access the Model 135 using the procedure in steps (2) through (5) of paragraph 3.03.

(5) Wait until the acknowledgment tone stops.

(6) Send DTMF characters corresponding to the desired dialing address.

(7) Send the DTMF character "C" to indicate the end of transmission.

(8) Observe that the ANS OFF-HOOK LED turns off, indicating the answer port has gone on-hook.

(9) Observe that the ORIG OFF-HOOK indicator LED lights, indicating the origination port is off-hook.

(10) Observe the completion of outpulsing by the origination port and successful completion of the call.

(11) Repeat steps (1) through (5).

(12) Send an erroneous address code.

(13) Send the DTMF character "B."

(14) Send the DTMF characters corresponding to the desired dialing address.

(15) Repeat steps (7) through (9).

**F. Origination Port Call
 Progress Detection
 Function Check**

3.07 To check the ability of the origination port to recognize call progress tones, perform the following:

- (1) Disconnect the ORIG TEL LINE interface from the active telephone circuit.
- (2) Access the Model 135 using the procedures in steps (4) through (9) of paragraph 3.06.
- (3) Observe that the ORIG OFF-HOOK indicator will turn-off approximately 3 seconds after it lights. This demonstrates no dial tone was encountered, thus causing termination of the call.

Busy Tone Recognition:

- (1) Intentionally busy-out a telephone station.
- (2) Connect a TMS to the ORIG LINE/MON jack on the Model 135. The TMS should be set for a bridged receive level measurement and an audio monitor left on the receive circuit.
- (3) Dial the busied-out telephone station with the Model 135 using the procedures in steps (3) through (9) of paragraph 3.06.
- (4) Observe the outpulsing of the address digits by the origination port.
- (5) Wait approximately 4 seconds from the time the last digit was outpulsed.

(6) Observe that the ORIG OFF-HOOK indicator turns off, signaling termination of the call.

**G. Authorization Code
 Verification (if
 Required)**

3.08 To verify that the authorization code is properly encoded, perform the following:

- (1) Connect a TMS capable of sending DTMF to the ORIG TEL LINE interface.
- (2) Depress the Manual Line Seizure switch on the Model 135.
- (3) Wait 3 seconds.
- (4) Detect the presence of 1004 Hz signal transmitted from the Model 135.
- (5) Send the 3 character DTMF authorization code.
- (6) Detect a quiet termination condition for the Model 135.
- (7) Send the DTMF command 33.
- (8) Detect the presence of a 1004 Hz signal transmitted by the Model 135.
- (9) Send the DTMF 83 on-hook command.

H. Test Tone Transmit Check Level and Frequency

3.09 To check the transmit level and frequency for the three test tones, perform the following:

NOTE Any measurements within ± 0.5 dB of the expected values is acceptable.

(1) Connect a TMS capable of sending DTMF to the ORIG TEL LINE interface. The TMS should have a 0.1 dB resolution and accuracy with the appropriate 600 Ω or 900 Ω characteristic impedance.

(2) Depress the Manual Line Seizure switch on the Model 135.

(3) Wait 3 seconds.

(4) Send the 3 character DTMF authorization code (if required).

(5) Send the DTMF command 73.

(6) Send the DTMF command 32.

(7) Detect the presence of a signal transmitted from the Model 135 at a frequency of 404 Hz and with a level equal to that preset during set-up.

(8) Send the DTMF command 33.

(9) Detect the presence of a signal at a frequency of 1004 Hz with a level equal to that preset during set-up.

(10) Send the DTMF command 34.

(11) Detect the presence of a signal at a frequency of 2809 Hz

with a level equal to that preset during set-up.

NOTE: The DTMF command 34 causes the Model 135 to "Transmit tone at 2804 Hz." In the case of the test tone, 2804 Hz is the nominal frequency value and is used to define the test tone in a manner consistent with the other two tones. The 2809 Hz frequency is the actual output from the oscillator in the Model 135.

(12) Send the DTMF 83 on-hook command.

I. Level Measurement Check

3.10 To check the receive level measurement functions within the Model 135, perform the following:

(1) Access the Model 135 using the procedure in steps (1) through (5) of paragraph 3.09.

(2) Set the TMS to transmit a 404 Hz signal at a known level within the specified measurement range of the Model 135.

(3) Send the DTMF command 42.

(4) Wait 10 seconds.

(5) Send the DTMF command 82.

(6) Set the TMS to transmit a 1004 Hz signal at a known level within the specified measurement range of the Model 135.

(7) Send the DTMF command 43.

- (8) Wait 10 seconds.
- (9) Send the DTMF command 82.
- (10) Set the TMS to transmit a 2804 Hz signal at a known level within the specified measurement range of the Model 135.
- (11) Send the DTMF command 44.
- (12) Wait 10 seconds.
- (13) Set the TMS to make a receive level measurement.
- (14) Send the DTMF command 46.
- (15) Detect the presence of the signal from the Model 135 at a level equal to the 404 Hz signal it measured.
- (16) Send the DTMF command 47.
- (17) Detect the presence of the signal from the Model 135 at a level equal to the 1004 Hz signal it measured.
- (18) Send the DTMF command 48.
- (19) Detect the presence of the signal from the Model 135 at a level equal to the 2804 Hz signal it measured.

NOTE: The commands 46, 47, and 48 all cause the Model 135 to send the three different measurements at a reference frequency of 1004 Hz.

- (20) Send the DTMF 83 on-hook command.

J. Noise Measurement Check

3.11 To check the noise measurement functions within the Model 135 perform the following:

- (1) Access the Model 135 using the procedure in steps (1) through (5) of paragraph 3.09.
- (2) Set a noise impairment simulator to transmit white noise at a level within the specified range of the Model 135.
- (3) Send a DTMF command 63.
- (4) Disconnect the TMS from the ORIG TEL LINE interface.
- (5) Connect the noise impairment simulator to the ORIG TEL LINE interface.

NOTE: The noise must be transmitted to the Model 135 within 5 seconds after it received the 63 command in order for the responder to make an accurate measurement.

- (6) Wait 10 seconds.
- (7) Disconnect the noise source.
- (8) Reconnect the TMS.
- (9) Set the TMS to make a receive level measurement.
- (10) Send a DTMF command 66.
- (11) Detect the presence of a signal from the Model 135 at a level equal to the noise it measured with the addition of 30 dB of gain.
- (12) Send a DTMF command 82.

(13) Set the noise source to transmit white noise at a level within the specified range of the Model 135 with the addition of a 1004 Hz holding tone.

(14) Send a DTMF command 62.

(15) Repeat steps (4) through (9).

(16) Send a DTMF command 64.

(17) Detect the signal sent from the Model 135.

(18) Send the DTMF 83 on-hook command.

4.0 Installation

4.01 This section contains the information necessary to properly install the Model 135. The Model 135 is configured as a self-contained, wall-mount type unit suitable for installation within a customer premises environment.

4.02 Remove the Model 135 from its shipping container, and perform a complete visual inspection for possible damage.

NOTE: If damage is found, notify the carrier immediately; do not destroy any packing material until an agent of the carrier has examined it. Under U.S. shipping regulations, damage claims must be submitted by the consignee; do not return the instrument to SBS Logistics Support Center, until a claim for damage has been established.

4.03 Choose a wall mounting location no more than 9 feet from the nearest 3-prong ac wall receptacle.

4.04 Attach two #8 pan head sheet metal or equivalent screws on 9-1/2 inch centers and a minimum of 8-1/2 inches from the floor. Use the enclosed template as an aid for accurate screw placement. Refer to Figure 4-1 for an example of the template.

4.05 Mount the unit to the wall by hooking the two slots found on the side of the enclosure onto the #8 screws.

4.06 Plug the Model 135 ac adapter into the ac receptacle. The LED labeled "POWER" will light, indicating the power is applied to the Model 135.

4.07 Connect a 2-wire telephone line to the RJ11C jack labeled "ORIG TEL LINE" to establish the test line interface.

NOTE: This telephone line will be a PBX station or maintenance access.

4.08 Connect a 2-wire telephone line to the RJ11C jack labeled "ANS TEL LINE" to establish the call-in circuit.

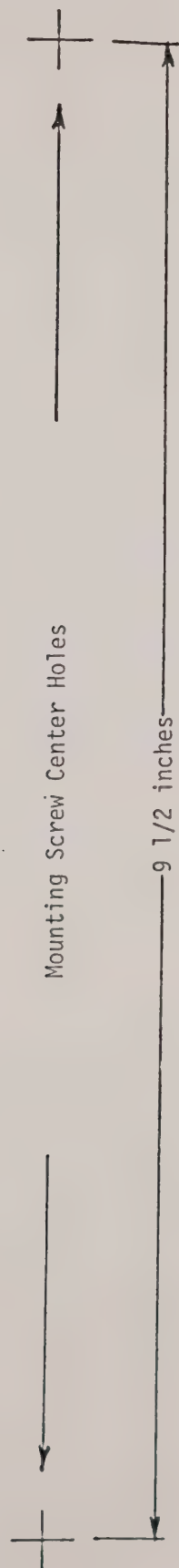
NOTE: This telephone line must be a DDD subscriber line, not a PBX station.

4.09 Dial the PBX extension number assigned to the Model 135. The LED labeled "ORIG OFF-HOOK" will light, indicating the origination port is functioning via the assigned circuit.

4.10 Wait till the "ORIG OFF-HOOK" LED turns off.

4.11 Dial the subscriber number assigned to the answer port on the Model 135. The LED labeled "ANS OFF-HOOK" will light, indicating the answer port is functioning.

NOTE: The Model 135 Responder will stay in the off-hook condition for approximately 30 seconds, at which time it will automatically return to the on-hook condition.



2-19

Instructions:

1. Tape the template to the wall in the desired mounting location. Insure that the mounting screw center holes are at least 8 1/2 inches from the floor.
2. Mark the mounting screw center holes on the wall using the template as a guide.
3. Remove the template.
4. Mount the #8 screws on the wall leaving the screw extended from the wall a distance of 11/32 to 13/32 inches measured from the base of the screw head to the wall.

Figure 4-1. TEMPLATE EXAMPLE

5.0 Operation

5.01 This section describes the techniques for using the Model 135 in support of remote test measurements. Once the Model 135 is deployed and properly installed, there are no special care and handling requirements for the operational units. Therefore, the following topics related to the operation of the Model 135 discuss the theory of operation relative to the employment of the Model 135 in test measurements in its two basic modes of operation. The Model 135 will support testing in either a manual mode or an automatic mode and this section describes particulars of each mode of operation. Table E contains the commands required to setup the answer port to initiate the dial outpulsing by the origination port. The DTMF commands necessary to operate the Model 135 origination port in the interactive/manual test mode are listed in Table F. Table G is a listing of the automatic test sequence programmed to operate from the origination port in the Model 135.

A. Theory of Operation

5.02 The answer port in the Model 135 is designed to provide a termination on a two-wire loop-start DDD subscriber circuit and will respond to ringing voltage, go off-hook, trip ring and provide approximately 2.7 seconds of quiet termination as required by FCC regulation. Initiate a call to the Model 135 by dialing the NNX assigned to the circuit on which the answer port of the Model 135 is terminated.

5.03 At the completion of the 2.7 seconds of quiet termination, the Model 135 will provide an acknowledgment signaled by the presence of a 1004 Hz test tone for a period of approximately 2.7 seconds. The answer port will then go quiet signaling the unit is ready to accept DTMF commands. Any commands sent prior to this second quiet period will be rejected. Once this quiet occurs, you have a period of 30 seconds to enter at least one of the DTMF commands specified in Table E. Each time a DTMF digit is entered, the off-hook timer is reset to 30 seconds to allow sufficient time to enter the address information desired. The answer port will automatically go on-hook 30 seconds after receipt of the last DTMF digit.

5.04 The DTMF character "C", which was sent to the answer port after the last address character, is the signal that the coding process is complete and the origination port address outpulsing sequence should begin. This character causes the answer port to go on-hook and the origination port to go off-hook in turn. The origination port will stay off-hook one second, waiting for the line conditions to stabilize. At the completion of this waiting period, the origination port begins a one second check for dial tone. If no dial tone is detected, the call will be terminated, whereas successful detection of dial tone causes the address out pulsing to begin. The origination port will then outpulse the address in the

(Continued on Pg. 2-25)

Table E. ANSWER PORT CALL SETUP COMMANDS

<u>DTMF Command</u>	<u>Function</u>
#	Causes a pause equal to 1 second during outpulsing from the origination port. It also causes the Model 135 to look for all progress tones at the completion of the waiting period.
D	Precedes the DTMF address code when dial-pulse signaling is required.
B	Indicates an error in coding, erases the code that was sent, and resets the 30 second off-hook timer.
C	End of transmission character puts the answer port on-hook and initiates off-hook at the origination port.
Digits 0 through 9	Encode the circuit address information.

Table F. ORIGINATION PORT INTERACTIVE/MANUAL COMMANDS

<u>DTMF Command</u>	<u>Function</u>
22	Find Line Loss
23	Reset Line Loss to 0
24	Start Automatic Sequence
32	Transmit Tone at 404 Hz
33	Transmit Tone at 1004 Hz
34	Transmit Tone at 2804 Hz
42	Measure 404 Hz Level
43	Measure 1004 Hz Level
44	Measure 2804 Hz Level
46	Transmit Indicated 404 Hz Level @ 1004 Hz
47	Transmit Indicated 1004 Hz Level @ 1004 Hz
48	Transmit Indicated 2804 Hz Level @ 1004 Hz
62	Measure C-Notch Noise
63	Measure C-Message Noise
64	Transmit Indicated C-Notch Noise at 1004 Hz +30 dB above the measured C-Notch Noise
66	Transmit Indicated C-Message Noise at 1004 Hz +30 dB above the measured C-Message Noise
72	Set Time Out Default Equal to 2 Min.
73	Set Time Out Default Equal to 5 Min.
74	Set Time Out Default Equal to 10 Min.
76	Set Time Out Default Equal to 15 Min.
77	Set Time Out Default Equal to 17 Min.
82	Quiet Termination
83	"On-Hook"

NOTE: The first digit of each DTMF command dictates the function listed below.

- 2 - Special Functions
- 3 - Test Tones
- 4 - N to F Level Measurement and Reply
- 6 - N to F Noise Measurement and Reply
- 8 - Non-Measurement Functions

Table G. ORIGINATION PORT AUTOMATIC TEST SEQUENCE

	<u>Responder</u>	<u>Test Equipment</u>
<F to N>	(1) Transmit 1004 Hz	Measure Level
	(2) Transmit 1004 Hz	Measure C-Notch Noise
	(3) Go Quiet	Measure C-Message Noise
	(4) Transmit 404 Hz	Measure Level
	(5) Transmit 2804 Hz	Measure Level
<N to F>	(6) Set 1004 Hz Level Indication	Transmit 1004 Hz
	(7) Set C-Notch Noise Indication	Transmit 1004 Hz
	(8) Set C-Message Indication	Go Quiet
	(9) Set 404 Hz Level Indication	Transmit 404 Hz
	(10) Set 2804 Hz Level Indication	Transmit 2804 Hz
<F to N>	(11) Transmit 404 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 404 Hz
	(12) Transmit 1004 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 1004 Hz
	(13) Transmit 2804 Hz Registered Level	Measure Level at 1004 Hz Equal to Level of 2804 Hz
	(14) Transmit C-Notch Noise Registered Level (+30 dB of the C-Notch Noise)	Measure Level at 1004 Hz (Add +60 dB Algebraically to Convert to dBrnC)
	(15) Transmit C-Message Noise Registered Level (+30 dB of the C-Message Noise)	Measure Level at 1004 Hz (Add +60 dB Algebraically to Convert to dBrnC)
<N to F>	(16) Go Quiet	Transmit White Noise & Measure EPL

Go "On-Hook"

Note 1: Automatic sequence timer provides 6 seconds for each step.

Note 2: The measurement of results by either the responder or test equipment will commence two (2) seconds after the beginning of each 6-second interval.

Note 3: "<N to F>" (Near to Far) indicates the direction of circuit transmission between, e.g., the test equipment being near and the responder being far.

"<F to N>" (Far to Near) indicates the reverse direction of circuit transmission.

exact sequence encoded via the answer port. Each time the origination port encounters the DTMF "#" character, it interprets that as a request to wait one second, after which it will perform a one second check for call progress tones. If dial tone is not detected during this check, the call will be terminated. Successful detection of dial tone continues the outpulsing until the complete address has been dialed. Once dialing is complete, the origination port begins a 1 second waiting period to allow for call completion by the near-end test system. At the completion of this waiting period, a busy signal check begins. If no busy is detected within one second, the origination port automatically begins its call acknowledgment sequence. If busy is detected, complete verification will take approximately 3 seconds at which time the call will be terminated.

NOTE: Only one of the ports in the Model 135 can be off-hook at any given time. Whichever port is accessed first will "lock out" the other port. Therefore address encoding can not occur in the answer port while the origination port is off-hook.

5.05 If no busy tone is encountered after dialing completion, the origination port begins a 2.7 second period of quiet. At the completion of the 2.7 seconds of quiet termination, the Model 135 will provide an acknowledgment signaled by the presence of a 1004 Hz test tone for a period of approximately 30 seconds. The presence of the signal also indicates the unit is

ready to accept DTMF, commands because commands sent during the initial quiet termination period are rejected. Once you have detected the presence of the test tone, there are approximately 30 seconds during the acknowledgment period in which you can send DTMF commands before the unit goes on-hook. The intent of the acknowledgment period is to allow the user to input an authorization/security code, if required, and a DTMF command that will set the test mode.

NOTE: The origination port on the Model 135 is also designed so that it can provide a termination on a two-wire loop-start circuit. It will therefore respond to incoming ringing voltage, go off-hook, trip ring, begin its acknowledgment sequence after the 2.7 seconds of quiet termination, and provide the 30 seconds of acknowledgment tone.

5.06 Valid DTMF commands for operation of the origination port on the Model 135 are defined as two DTMF digits separated by not more than one second of interdigit timing and are listed in Table F. Failure to send the digits within the specified interdigit timing will cause the Model 135 to reject the command.

NOTE

The interdigit timing is critical on the DTMF commands. Inputting commands from a manual keypad may take some practice. Delay inputting digits may cause an invalid command.

5.07 The authorization/security code is a means to limit access to the Model 135 by unauthorized users. The code is defined as a three digit DTMF command, consisting of an alphabetical character derived from a 4X4 keypad matrix, followed by one of the two digit combinations listed in Table D. If the Model 135 is set-up to require this code, it must be sent prior to any other commands during the acknowledgment period. Failure to send the code will cause the 135 to reject all DTMF commands and revert to an on-hook condition after providing 30 seconds of acknowledgment tone. When the proper code is received by the Model 135, it will interrupt the acknowledgment tone and provide a quiet termination for a period of 30 seconds. If the responder does not receive a valid DTMF command in that period, it will automatically revert to the on-hook condition.

5.08 The Model 135 origination port has two basic modes of operation, an interactive/manual mode and an automatic mode. The manual mode of operation is distinguished by the fact that test measurements and control of the Model 135 are directed from a manual test position under the direct control of a technician. The Model 135 is placed in this mode by the receipt of any of the extended timeout commands. The automatic operation of the Model 135 is characterized by one of two methods which are differentiated by the means for controlling the test measurement sequence. In the automatic mode the Model 135 is either under the control of its own programmed internally timed test sequence or

under the direct commanded control of an automatic test measurement system. The internal automatic test sequence is initiated by sending a DTMF 24 command after the unit has been properly accessed. On the other hand, the commanded or interactive automatic mode is the normal operating condition for the Model 135 and no special command is required to set it to this operational configuration.

5.09 The origination port on the Model 135 is held off-hook with a microprocessor controlled circuit which holds the test circuit for a specific period of time determined by the mode of operation. In the automatic mode controlled by the internally time test sequence, the Model 135 goes on-hook at the completion of the test sequence. In the automatic interactive/commanded mode, the off-hook timeout is 30 seconds. When in the interactive/manual mode, the off-hook timeout is determined by the timeout command chosen from Table F. In each case, the timeout indicates how long the Model 135 will remain off-hook waiting to receive a valid DTMF command. Likewise, the Model 135 will remain in the last commanded state for a period of time equal to the appropriate timeout. If no valid command is received prior to completion of this period, the Model 135 will go on-hook.

5.10 The Model 135 will make only one successive approximation measurement when commanded to measure either a level or noise. This measurement will begin within a specific time after the unit has received the DTMF command

requesting the measurement. The actual point at which the measurement begins is determined by the operational mode of the responder. Measurements made in the manual mode occur 5 seconds after receipt of the command, whereas measurements made in the automatic commanded mode will occur 460 ms after receipt of the command. During the internally programmed automatic test sequence, the measurements occur 2 seconds after the beginning of a measurement interval.

5.11 The specified test conditions must be present on the line under test prior to the beginning of the test measurement period and must be maintained throughout the complete measurement period for an accurate measurement to occur.

5.12 Any valid DTMF commands, which are received by the Model 135 during the actual measurement period required to execute a level or noise measurement command, will invalidate the results of the measurement in progress. Invalid DTMF digit pairs received during this same period will cause the measurement in progress to be terminated and the Model 135 to revert to the on-hook condition.

5.13 Once the Model 135 has taken a measurement, the results are stored in RAM memory within the Model 135 and can be recalled anytime while the unit remains in the off-hook condition. The stored values are cleared from RAM

once the origination port goes on-hook, or when a new measurement is made.

5.14 The DTMF command 64 or 66 causes the Model 135 to transmit a 1004 Hz signal at a level equal to the noise it measured, with 30 dB gain added to the signal to put the level within a range that can be detected by a TMS. Therefore, it is important for the near end TMS to be set to make a level measurement when using this command. It is also important to note that the reading taken from the TMS is a level measurement and must be manually converted to a noise reading by adding a noise conversion factor of 60 to any reading taken. Likewise, since the Model 135 is sending a level, the level received at the near-end TMS will be reduced equal to the amount of far-to-near loop loss in the circuit between the TMS and the Model 135. Thus, it is necessary to add this loss to the TMS reading to come up with the adjusted noise reading. Refer to the following example and Figure 5-1 for further details.

Example:

Rec'd level at TMS	
Referenced to Noise=	-37.0 dBm
Adjustment for	
Loop Loss (F>N)=	(-) -2.0 dB
Adjusted Level	-35.0 dBm
Model 135 Noise	
Conversion Factor	+60.0
Calculated Noise	
Reading	25.0 dBrnC

even if the test measurement indicated a level that was lower than -50 dBm or a noise reading that was better than 10 dBrnC. However, the response of the Model 135 at the upper limit of its range (i.e., -10 dBm or 50 dBrnC) is completely different. When these limits are exceeded, the Model 135 will not transmit because the signals for measurements that exceed the Model 135 upper limit may exceed the maximum allowable transmit level under FCC Regulations.

B. Manual Operation

5.16 To initiate a test with the Model 135, proceed as follows:

(1) Apply a minimum of 1 second of ringing voltage via the ANS TEL LINE interface on the Model 135.

(2) Detect the presence of the acknowledgment tone transmitted from the Model 135 answer port.

(3) Wait approximately three seconds.

(4) Detect the presence of a quiet termination.

(5) Send the desired test circuit address sequence.

(6) Send the DTMF character "C" to initiate the signal outputting by the origination port.

(7) Set up the TMS for call completion at the near end of the desired test circuit.

(8) Detect incoming ringing on the test circuit and go off-hook.

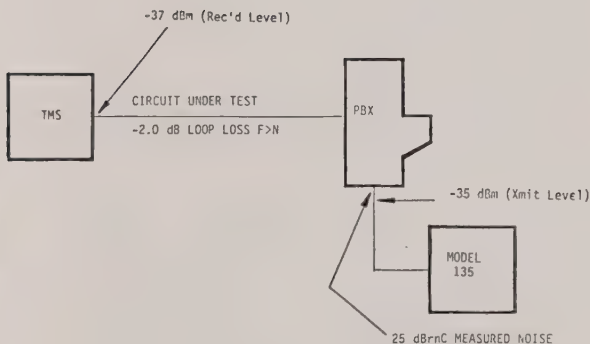


Figure 5-1. Transmission of Indicated Noise Measurement

5.15 The Model 135 will transmit the results of its measurements as a level at 1004 Hz equal to the level it received, or in the case of noise measurement the equivalent level will be returned with 30 dB of gain. When the test measurement conditions exceed the specified range of the Model 135, the response of the unit will differ based on what limit is exceeded. At the -50 dBm or 10 dBrnC lower limit of the range, the unit will "clamp" or send a signal at a -50 dBm level,

(9) Monitor the circuit to detect the presence of the 1004 Hz acknowledgment tone sent by the Model 135 origination port.

(10) Send the 3 character DTMF authorization/security code (if required).

(11) Send a DTMF timeout command found in Table F to place the Model 135 into an extended timeout, and the commanded mode of operation.

(12) Send the appropriate DTMF test commands found in Table F to perform the desired measurements.

(13) Send the DTMF command 83 to return the Model 135 to the on-hook condition at the completion of the desired testing.

NOTE: FAILURE TO SEND THE DTMF ON-HOOK COMMAND AT THE COMPLETION OF TESTING WILL CAUSE THE MODEL 135 TO REMAIN OFF-HOOK AND INACCESSIBLE TO INITIATION OF ANY NEW CALL-UP UNTIL THE DESIGNATED TIMEOUT SEQUENCE HAS BEEN COMPLETED.

5.17 The Model 135 has a feature which is useful in certain manual test applications. The "ORIG MANUAL LINE SEIZURE" switch located on the front panel of the Model 135 will cause the origination port to go off-hook as though it has received ringing voltage or internal command. Once off-hook, the Model 135 will function just as though it had been accessed via the telephone interface and therefore the test initiation sequence described in paragraphs 5.16, (9) through (13) must be performed. This feature would allow a technician to insert the Model 135 into an active

circuit, hold the circuit and then perform troubleshooting type measurements. This is especially helpful when a suspect circuit is accessed, but having to redial to access a test device would cause the loss of the circuit to be tested.

C. Automatic Operation

5.18 Initiation of the test measurement sequence in the automatic mode is identical to the method defined for the manual mode in paragraphs 5.16 (1) through (10). Once the origination port is accessed, the next step is to determine the means of control for the test sequence.

5.19 If the internal timed sequence is the preferred means of control, send the DTMF command 24. When the Model 135 receives this command, it will automatically proceed through the test sequence identified in Table G. At the conclusion of the sequence, the origination port will automatically go on-hook. If the commanded automatic mode is preferred, control of the test sequence will be established by the test measurement system which has been preprogrammed to send the appropriate DTMF commands to perform the desired tests. The test system must send a DTMF 83 on-hook command to terminate the test sequence and return the origination port to the on-hook condition.

6. Preventive Maintenance

6.01 The Model 135 Responder has no preventive maintenance requirements. Once the responder is operational, it will require no routine maintenance intervention.

7. Trouble Analysis

7.01 The Model 135 is an FCC Registered device which limits the extent of the trouble analysis performed. Therefore, the trouble analysis would necessarily focus on the overall functional performance of the responder. As such, the checkout procedures identified in Volume 2, Section 3 of this manual form the basis of the trouble analysis procedure. In order to isolate or identify failure within the responder, it is necessary to consider the following major causes of failure that can be detected from the external interfaces: (1) lack of ac power: (2) inability of the answer port to detect ring, perform call acknowledgment, initiate signal outputting by the origination port and have the origination port complete the outputting: (3) the inability of the origination port to respond to DTMF commands once it is connected to the line under test.

A. AC Power

7.02 To verify that the responder is receiving the required ac power, perform the following steps:

(1) Confirm that the unit is receiving power by observing that the power indicator LED on the front panel is lit. If lit, proceed to the ring detection performance check. If not lit, perform the following:

(a) Verify the presence of ac power at the receptacle to which the Model 135 is connected. If present, proceed to step 2.

(2) Check the connection between

the ac adaptor on the Model 135 and the ac power source. If LED lights, proceed to the answer port performance check. If LED does not light, perform the following:

(a) Remove the Model 135 enclosure cover.

(b) Check the two power fuses located in the rear section of wall mount enclosure chassis.

If the fuses are intact, the failure exceeds the authorized field maintenance capabilities and the unit must be returned for repair.

(3) If the fuses are blown, proceed as follows:

(a) Unplug the ac adapter from the ac receptacle.

(b) Replace the fuses.

(c) Plug the ac adapter into the receptacle.

(d) Confirm ac power to the unit by checking to see that the power indicator LED is lit.

(e) If LED lights, proceed to the answer port performance check.

(f) If LED does not light or fuses are blown, the unit must be returned for repair.

B. Answer Port Origination
Port Signal Outpulse
Performance

7.03 To perform a trouble analysis of the answer port and origination port for ring detection, call acknowledgment, initiation of the address signal outpulsing and the actual address outpulsing follow the check-out procedure listed in paragraph 3.06 in Volume 2. Plan to complete the incoming call to a telephone station within direct control and observation of the tester.

NOTE: FAILURE OF THE MODEL 135 TO DETECT RING DOES NOT NECESSARILY MEAN THE UNIT HAS FAILED. A SERIOUS FAILURE ON THE CIRCUIT TO THE ANSWER PORT, SUCH AS AN OPEN CIRCUIT, MAY CAUSE THE RESPONDER TO FAIL THIS TEST. THEREFORE, YOU MUST ALSO VERIFY THE PERFORMANCE OF THE CIRCUIT UNDER TEST IN ORDER TO ISOLATE THE PROBLEM TO THE MODEL 135.

C. Origination Port
Response To DTMF
Commands

7.04 To perform the trouble analysis for DTMF recognition, complete the following steps:

- (1) Access the Model 135 in the same manner as in paragraph 7.03.
- (2) Send the authorization code (if required).
- (3) Send the DTMF command 24.
- (4) Monitor to see that the responder begins the automatic test sequence.
- (5) Interrupt the test sequence with any valid DTMF command.

NOTE: If the Model 135 responds to DTMF commands and performs the commanded functions, it can be assumed that the unit is functioning properly. Refer to Paragraphs 5.02 through 5.14 of Volume 2 for clarification of DTMF commands and insure that the DTMF commands transmitted under test conditions are consistent with the stated requirements.

8. Tools and Test Equipment Required

8.01 The recommended test equipment and tools required to check out and test a Model 135 Responder are contained in Table H.

TABLE H
TEST EQUIPMENT AND TOOLS

1. Hekimian Laboratories, Inc., Model 3910L Communications System with .04 Option - Remote Control capability equipped with the following modules:

- Model 3916 Return Loss Module with .04 Option
- Model 3925-232 Module with .02 Option, DTMF/MF Signaling
- Model 3927-1 Remote I/O Module
- Model 3928-1 Remote Noise Filter Module (C-Message Filter)
- Model 3935 Remote Call Progress Module

or

Hekimian Laboratories, Inc., Model 3701 Communication Test System, with Option .16 Return Loss and Option .60 DTMF/MF Signaling

2. CRT Terminal
3. Bradley Telecom Corp., Model 2A Line Simulator
4. Alignment Tool

5. Hekimian Laboratories, Inc., Model 110, Dialed Number Recorder.

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No. 34114

The Mead Corporation, Dayton, Ohio 45408 U.S.A.

